Draft
RCRA CLOSURE OF THE RFETS SOLAR EVAPORATION PONDS

PROPOSED ACTION MEMORANDUM

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APPENDIX

TABLES AND FIGURES

ACRONYMS AND ABBREVIATIONS

AL	Action Level
ALARA	As Low As Reasonably Achievable
ALF	Action Levels and Standards Framework
AOC	Area of Concern
BMP	Best Management Practice
CCR	Colorado Code of Regulations
CDH	Colorado Department of Public Health
CDPHE	Colorado Department of Public Health and Environment
CDD	Closure Description Document
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CHWA	Colorado Hazardous Waste Act
COC	Contaminant of Concern
DOE	Department of Energy
EPA	Environmental Protection Agency
ER	Environmental Restoration
FY	Fiscal Year
GIS	Geographic Information System
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HI	Hazard Index
HHRA	Human Health Risk Assessment
HRR	Historical Release Report
HSWA	Hazardous and Solid Waste Amendments
IA	Industrial Area
IAG	Inter-Agency Agreement
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
ISMS	Integrated Safety Management System
ITS	Interceptor Trench System
IWCP	Integrated Work Control Program
JHA	Job Hazard Analyses
K-H	Kaiser-Hill
mg/Kg	Milligram per kilogram
mg/L	Milligram per liter
MSTs	Modular Storage Tanks
NEPA	National Environmental Policy Act
NFA	No Further Action
NPWL	New Process Waste Lines
OPWL	Original Process Waste Lines
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PA	Protected Area
PAC	Potential Area of Concern
PAM	Proposed Action Memorandum
pCi/L	Picocurie per liter
PCOC	Potential Contaminant of Concern

ppb	Part per billion
PPE	Personal Protective Equipment
ppm	Part per million
PRG	Preliminary Remediation Goals
RAAMP	Radioactive Ambient Air Monitoring Program
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RME	Reasonable Maximum Exposure
RMRS	Rocky Mountain Remediation Services
RSOP	RFCA Standard Operating Protocol
SAP	Sampling and Analysis Plan
SEPs	Solar Evaporation Ponds
SPP	Solar Pond Plume
SVOC	Semi-Volatile Organic Compound
SWD	Soil Water Database
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TLL	Total Long Lived
TM	Technical Memorandum
UBC	Under Building Contamination
UHSU	Upper Hydrostratigraphic Unit
VOC	Volatile Organic Compound
WARP	Well Abandonment Replacement Program
WRW	Wildlife Refuge Worker

EXECUTIVE SUMMARY

Closure of the Solar Evaporation Ponds (SEPs), Individual Hazardous Substance Site (IHSS) 101, at Rocky Flats Environmental Technology site (RFETS), is proposed under alternative Resource Conservation and Recovery Act (RCRA) Interim Status closure requirements found in 6 CCR 1007-3, 265.110(d) since a release from the SEPs has occurred and releases from other units in the area of the SEPs have also contributed to this contamination. This alternative approach allows contamination from these units within this area to be evaluated holistically as one Area of Concern (AOC), and allows RCRA closure using a risk-based analysis and compliance with the closure performance standards in 6 CCR 1007-3, 265.111 (a) and (b). A risk assessment was performed based on identified contaminants of concern (COCs) within the AOC and these findings are included in this Proposed Action Memorandum (PAM). (The AOC is equivalent to IHSS 101 with a few modifications.)

The risk assessment included an evaluation of existing soil and pond liner material analytical data stored in electronic format in the RFETS environmental Soil Water Database (SWD), which was collected during previous Phase I field investigations and site-wide sampling programs. This data was screened and COCs were selected and evaluated to determine risk posed to future human wildlife refuge workers (WRW). Based on the results of the risk assessment, the cumulative hazard index (HI) for non-carcinogenic health effects is well below 1 at 0.04. The total cancer risk to a WRW due to RCRA constituents (for purposes of RCRA closure) is below 1 excess cancer case per 1 million exposed individuals (1E-06) at 3E-07. The total cancer risk to a WRW due to radionuclides (for purposes of addressing IHSS 101) is 2E-06, with the major contributor to risk being Americium-241 and Uranium-235.

Corrective action of existing groundwater contamination, including treatment, is addressed in a separate Interim Measure/Interim Remedial Action (IM/IRA) decision document.

The other units within the AOC were removed as a separate action under the Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocol (RSOP) for Routine Soil Remediation (ER RSOP; DOE 2002a) (refer to ER RSOP FY02 Notification 02-08; DOE 2002b). These components included the removal of concrete slabs, above-grade lines, segments of below grade lines, valve vaults, collection sumps, manholes, electrical control conduit and other utilities, associated support racks, concrete ramps and barriers. To determine if contamination was present at specific locations where soil or component removal was anticipated, an Industrial Area (IA) Sampling and Analysis Plan (SAP) Addendum was also submitted (IA SAP Addendum 02-07; DOE 2002d). Soil with contaminant concentrations greater than RFCA Tier I Action Levels (ALs) and associated debris were removed in accordance with RFCA and the Environmental Restoration (ER) RSOP. In addition, lysimeters and unneeded monitoring wells were abandoned as a separate action under the Well Abandonment and Replacement Program (WARP) (refer to Kaiser-Hill 2002).

Based on applying the alternative closure requirements, the results of the risk assessment indicate RCRA constituents pose less than 1E-05 residual risk for a WRW and with the completion of the actions performed under the ER RSOP and IA SAP, the SEPs meet the closure performance standards of 6 CCR 1007-3, 265.111(a) and (b). In addition, the radiological contaminants remaining within the SEPs AOC soil, are all below current RFCA Tier I action levels (ALs), are below 1E-05 risk to a WRW, and are below proposed soil ALs. Therefore, No Further Action (NFA) is required for the SEPs and IHSS 101. Upon approval of this PAM, the pond berms will be pushed into the ponds, clean fill soil will be brought in and the area will be regraded and vegetated as a best management practice.

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1.0 INTRODUCTION

This Proposed Action Memorandum (PAM) decision document serves as the Resource Conservation and Recovery Act (RCRA)/the Colorado Hazardous Waste Act (CHWA) closure plan for closure of the Solar Evaporation Ponds (SEPs), Individual Hazardous Substance Site (IHSS) 101. The SEPs are a RCRA interim status unit for which accelerated actions and closures are regulated under the Rocky Flats Cleanup Agreement (RFCA; DOE, CDPHE, EPA, 1996), which are approved by the Department of Energy (DOE), the Colorado Department of Public Health and Environment (CDPHE) and the Environmental Protection Agency (EPA). RFCA is both a cleanup agreement under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and a compliance order on consent under RCRA and CHWA.

Pursuant to RFCA, the SEPs are a RCRA interim status unit and are subject to specific RCRA closure requirements. However, since the signing of RFCA in July 1996, EPA amended the RCRA regulations in October 1998 (October 22, 1998 *Federal Register,* 63FR56710) (which were adopted by CDPHE in 1999) governing the closure of regulated units [6 Colorado Code of Regulations (CCR) 1007-3, Section 265.110(d)]. The amended regulations allow regulated units with releases into the environment, such as the SEPs, to close under a risk-based approach, if other Solid Waste Management Units (SWMUs) have or are likely to have contributed to the release. Other units that exist in this area include a portion of IHSS 121 (the Original Process Waste Lines, OPWL), RCRA Units 21 and 48 (RCRA stable concrete pads), a portion of the RCRA Permitted New Process Waste Lines (NPWL; RCRA Unit 374.3), and Potential Area of Concern (PAC) 900-1310 [Interceptor Trench System (ITS) water spill]. This alternative approach allows the SEPs to be closed under RCRA through the corrective action program, in conjunction with the removal and closure of these other units. This flexibility allows contamination from all of these units to be evaluated holistically as one area of concern and the removal of contaminated soils to be considered as an alternative to closure by capping the SEPs.

Currently, the closure in place of the SEPs is addressed in RFCA Attachment 10, "RCRA/CHWA Closure for Interim Status Units", Section I. Closure in place assumes that residual hazardous waste and hazardous waste constituents and liners have not been removed from the interim status unit. Attachment 10 requires closure in place using a cap or cover that meets specified design criteria. This PAM proposes to close the SEPs in accordance with revised RCRA regulations at 6 CCR 1007, 265.110(d) that were promulgated subsequent to the current Attachment 10 (July 1996), which provides for alternative risk-based closure standards. DOE will propose a modification to Attachment 10 to recognize this regulatory change for other interim status units covered by RFCA as part of a larger package of proposed modifications to several RFCA Attachments. However, because the other RFCA Attachments, proposed modifications are still under development, this PAM specifically recognizes the alternative closure method and describes the criteria to be met for SEPs closure.

An Area of Concern (AOC) is defined to include all of these units, spills within the SEPs area and the known extent of contamination associated with these units, which becomes the basis for performing a risk assessment (Appendix A, Figure 1). The AOC is equivalent to IHSS 101 with a few modifications, which are explained further in Sections 2.1.3 and 5.0. Contamination, for purposes of determining risk, and takes into account both radiological and non-radiological contaminants. However, for purposes of demonstrating compliance with RCRA closure, only those non-radiological contaminants, which are considered RCRA hazardous constituents, have been considered. All the RCRA units located in this AOC will be closed either by removal or based on risk.

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The other units that may have contributed to the release in this AOC are discussed in Section 2 of this PAM. Existing environmental data[1] used in the risk assessment included process knowledge and data collected during previous studies [e.g. the Phase I RCRA Facility Investigation (RFI)/Remedial Investigation (RI)]. A summary of the risk assessment results is presented in Section 5.0, and the risk assessment process is discussed in Appendix A, including data used (Section 2.0 of Appendix A).

However, specific actions associated with these other units have already been addressed under Environmental Restoration (ER) RFCA Standard Operating Protocol (RSOP) notification #02-08 and Industrial Area Sampling and Analysis Plan (IA SAP) Addendum #IA-02-07. Completion of the closure/remediation of these units will be documented in a separate closeout report. In addition, existing groundwater contamination is discussed in this document briefly for purposes of defining the nature and extent of contamination and to determine if additional soil removal could reduce any long-term stewardship obligations of the Solar Ponds Plume (SPP) treatment system. However, corrective action of existing groundwater contamination, including treatment, is addressed in a separate Interim Measure/Interim Remedial Action (IM/IRA) decision document. (Refer to the Final Solar Ponds Plume Decision Document, DOE 1999, and its Minor Modification, DOE 2002c.)

ER RSOP Notification 02-08 was submitted to the regulatory agencies in July 2002 for the SEPs AOC and approved by CDPHE on July 30, 2002. The purpose of this notification was to invoke the ER RSOP for the various other units, IHSSs, and PACs that exist within the SEPs AOC. This notification indicated that completing closure by removal for RCRA Units 21 and 48 was conducted in accordance with the existing RCRA Closure Description Document (CDD) for B788 (RMRS 1999). Partial closure of NPWL (RCRA Unit 374.3) was conducted in accordance with Section 6.5.3 of the ER RSOP and the ER RSOP Notification 02-08, which is in lieu of a RCRA CDD. Potential contaminants of concern (PCOCs) for these units were identified based on the same data used in the risk assessment as well as additional data from Historical Release Reports (HRR) for Rocky Flats Plant from 1992-2001 and the Final Closeout Report for Building 788 (RMRS 1999).

Soil with contaminant concentrations greater than RFCA Tier I Action Levels (ALs) and associated debris were removed in accordance with RFCA and the ER RSOP. Soil with contaminant concentrations less than RFCA Tier I ALs was evaluated for additional removal through the consultative process based on risk and using Stewardship and As Low As Reasonably Achievable (ALARA) considerations. Actions undertaken will be documented in a closeout report, which includes an estimate of material removal and related risk reduction.

IA SAP Addendum #IA-02-07 was submitted to the regulatory agencies in July 2002 and approved by CDPHE on August 1, 2002. The purpose of sampling in the SEP AOC was to determine if contamination was present at specific locations where soil or component removal occurred and in areas that may be affected by regrading.

[1] Data collected in 2002 as a result of the activities identified under ER RSOP notification 02-08 and IA SAP Addendum 02-07 was not included in the data set used in the risk assessment.

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1.1 Purpose and Objective

The purpose of this PAM is to serve as the RCRA Closure Plan for the SEPs (which supercedes any existing closure plans for the SEPs) and to propose that upon closure no further RFCA accelerated action is necessary for the SEPs and IHSS 101. This proposal for no further action is based on the nature and extent of contamination, previous actions taken including the removal of the waste (source of contamination) from the ponds, actions conducted under the ER RSOP, characterization/confirmation sampling conducted under the IA SAP and the results of the risk assessment for the SEP AOC. The objectives of this proposed action are:

- To define the alternative closure requirements and strategy for closing the SEPs;
- To evaluate the risks associated with existing contamination within the defined AOC;
- To demonstrate compliance with the RCRA closure performance standards of 6 CCR 1007-3, Section 265.111 (a) and (b) (this demonstration includes leaving the asphalt liner material in place); and
- To propose that no further accelerated action is necessary under this PAM since residual contamination does not pose an unacceptable risk to the anticipated future user, the wildlife refuge worker (WRW) [Calculated risk is 2E-06 and the toxicity Hazard Index (HI) is 0.04. See Section 5.0.]

This PAM discusses the current nature and extent of contamination within this AOC based on existing data, and presents the results of a risk assessment. Results of the risk assessment were used to determine if any actions or if additional sampling was warranted to protect public health and the environment. Actions undertaken under the ER RSOP will be documented in a closeout report.

1.2 RCRA Closure Requirements

The SEPs, as a RCRA interim status unit, must comply with the closure requirements of 6 CCR 1007-3 Part 265, Subpart G-Closure and Post-Closure. In general Subpart G requires the submittal of a closure plan for closure of interim status units. This PAM acts as the closure plan for the SEPs. Demonstration of 6 CCR 1007-3, Part 265, Subpart H-Financial Requirements for Closure, is not required for government-owned facilities [6 CCR 1007-3, Section 265.140(c)].

In addition to the submittal of a closure plan, Subpart G requires a facility to be closed in a specific manner. Closure of the SEPs will follow the alternative closure requirements as specified in 6 CCR 1007-3, §265.110(d).

This PAM is proposing to close the SEPs using alternative requirements for closure under 6 CCR 1007-3, §265.110(d), which allows all or part of the Subpart G-Closure and Post-Closure requirements for regulated units to be replaced. The alternative closure requirements must protect human health and the environment by meeting the closure performance standard of 265.111(a) and (b). However, three criteria must be met in order to apply these alternative requirements:

- The regulated unit[2] must be situated among solid waste management units (SWMUs)[3];

[2] A regulated unit is defined as a surface impoundment, waste pile, land treatment unit or a landfill that receives hazardous waste after July 26, 1982 [6 CCR 1007-3, §264.90(a)(2)].

[3] SWMUs are defined as any unit at a facility from which hazardous constituents might migrate, irrespective of whether the units were intended for the management of solid and/or hazardous waste. (July 24, 1987 EPA Memorandum OSWER 9502.1987 (07), RCRA/Superfund Hotline Faxback #12984; as explained in the July 15, 1985 HSWA Codification Rule.)

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- A release has occurred; and
- Both the regulated unit and one or more SWMUs are likely to have contributed to the release.

Therefore, to demonstrate that the SEPs qualify for closure in accordance with these alternative requirements, the following information is provided:

- The SEPs are considered a regulated unit in that they are surface impoundments that received hazardous waste until 1986 (after July 26, 1982);
- Situated among the SEPs is a portion of IHSS 121 (OPWL), RCRA Units 21 and 48 (concrete pads brought to RCRA stable), a portion of RCRA Unit 374.3 NPWL, and PAC 900-1310 (ITS water spill);
- OPWL, NPWL and RCRA Units 21 and 48 qualify as SWMUs;
- A release has occurred in this area;
- The SEPs, a portion of OPWL, PAC 900-1310, and RCRA Units 21 and 48 are likely to have contributed to the release in this area; and
- It is not necessary to apply the closure requirements of 6 CCR 1007-3, 265 Subpart G, since a risk assessment is presented in this PAM to ensure protection of human health and the environment. For purposes of managing risk, additional actions in this area have occurred under the ER RSOP and IA SAP to ensure protection to human health and the environment.

RCRA Unit 48 has interim status and both RCRA Unit 21 and a portion of NPWL are permitted. Each of these units qualifies as SWMU in that hazardous constituents may have migrated from these units. The definition of a SWMU is intended to include those types of units, which have traditionally been subject to regulatory controls under RCRA, such as container storage areas and tanks[4]. Although PAC 1310, which is described as a one-time spill of ITS water, does not qualify as a SWMU, this area was evaluated based on risk and on the location of this spill within the AOC. (SWMUs and corrective action were not intended to include one-time accidental spills, which cannot be linked to a discernible solid waste management unit.[4])

Based on the demonstration that the SEPs qualify for applying alternative closure requirements, the alternative closure requirements are defined as:

- Achieve protective media cleanup standard for human health at 1E-05 risk for a WRW; and
- Comply with the closure performance standard in 6 CCR 1007-3, 265.111(a) and (b), which are:
  - Minimize the need for further maintenance; and
  - Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.

In order to demonstrate successful closure of the SEPs, Section 6.1 of this PAM discusses these performance standards in relation to the risk assessment (Section 5.0 and Appendix A), and the accelerated actions conducted under the ER RSOP (Section 2.0).

[4] SWMUs are defined as any unit at a facility from which hazardous constituents might migrate, irrespective of whether the units were intended for the management of solid and/or hazardous waste. (July 24, 1987 EPA Memorandum OSWER 9502.1987 (07), RCRA/Superfund Hotline Faxback #12984; as explained in the July 15, 1985 HSWA Codification Rule.)

2.0 SITE DESCRIPTION

RFETS is a government-owned, contractor-operated facility formerly used for the fabrication of special nuclear materials for national defense. The 6,550-acre site is located in Jefferson County, Colorado, approximately 16 miles northwest of Denver. The site occupies approximately 10 square miles.

Centrally located within the RFETS boundary is a 400-acre security area called the Industrial Area (IA). A high-security Protected Area (PA) is located within the IA. The IA contains approximately 400 buildings along with other structures, roads, and utilities, and is where the majority of RFETS mission activities took place between 1951 and 1989. The remaining 6,150 acres consist of undeveloped land used as a buffer zone to further limit access to the operations area.

2.1 SEPs

Operations at the site resulted in the generation of process wastewater containing radioactive and hazardous waste constituents that were managed in various waste-processing units. The SEPs, located in the northeastern portion of the former PA boundary, were used as some of these waste-processing units (Figure 2-1) from 1953 to 1986. The SEPs consist of five current or existing surface impoundments designated as SEPs 207-A, 207-B North, 207-B Center, 207-B South, and 207-C, as well as three original surface impoundment cells (DOE, 1988). Figure 2-2 shows the locations and relative dimensions of the original and current SEPs, as well as the chronological history of pond construction, operation and removal. The first pond was constructed in 1953, and the last pond (207-C) was placed into service in 1970.

The operational history of the SEPs is summarized below. For information regarding the environmental setting, including geological, hydrogeological and ecological setting, review the following documents:

- *Final Solar Ponds Plume Decision Document,* U.S. DOE 1999;
- *Operable Unit 4—Solar Evaporation Ponds, Interim Measure/Interim Remedial Action Environmental Assessment Decision Document,* U.S. DOE, RFETS, February 1995;
- *Cumulative Impacts Document,* U.S. DOE, RFETS, June 10, 1997;
- *Geologic Characterization Report for the Rocky Flats Environmental Technology Site,* Volume I of the Site Wide Geoscience Characterization Study, EG&G, March 1995; and
- *Hydrogeologic Characterization Report for the Rocky Flats Environmental Technology Site,* Volume II of the Sitewide Geoscience Characterization Study, EG&G, April 1995.

2.1.1 History

The SEPs were operated primarily to store and evaporate radioactive process wastes and neutralized acidic process wastes containing primarily low concentrations of radionuclides and high concentrations of nitrate and aluminum hydroxide from 1953 to 1986. The SEPs were used to manage liquid process waste having less than 100,000 picocuries per liter (pCi/L) of total long-lived alpha activity (DOE, 1992a). Specific materials placed into the SEPs include:

- Radioactively contaminated aluminum scrap;

- Leachate from sanitary landfill[5];
- Alcohol wash solutions;
- Drums of waste radiography solutions;
- Treated sanitary effluent;
- Ground water collected from the ITS;
- Saltwater solutions;
- Wash waters from the decontamination of production personnel;
- Cyanide wastes;
- Acid wastes; and
- Other compounds such as sodium, cadmium, nitrate, ferric chloride, lithium chloride, sulfuric acid, ammonium persulfate, hydrochloric acid, nitric acid, and hexavalent chromium.

In addition to the above chemicals and compounds, it is reported that lithium scrap was reacted with water adjacent to the SEPs, and the solution was transferred to the SEPs. Based on these historical records, characteristic (D006) and listed (F001, F002, F003, F005, F006, F007, and F009) hazardous wastes were placed into the SEPs (DOE, 1995). However, based on additional historical investigation, the following waste codes were potentially received by the SEPs: D001, D002, D004[6], D005, D006, D007, D008, D009, D010, D011, F001 (Trichloroethene[7], 1,1,1-Trichloroethane[7], and Tetrachloroethene[7]), F002 (Methylene chloride, and 1,1,2-Trichloro-1,2,2-Trifluoroethane), F003 (Acetone and Methanol), F005 (Toluene and Methyl Ethyl Ketone), F006, F007, and F009 (RMRS, 2000 and RMRS, 1999b).

Routine placement of process wastewater into these ponds ceased in 1986 due to changes in the RFETS waste treatment operations. Leakage from the SEPs and related components (e.g., drainage tiles, leak detection systems, and collection sumps) has contaminated the shallow groundwater in the area with uranium and nitrate contaminants. This SPP has migrated down the hillside to the north of the SEPs. The primary contaminants in the SPP are uranium and nitrate [refer to the *Final Solar Ponds Plume Decision Document*, DOE 1999. (This decision document was a major modification to the *Final Proposed IM/IRA Decision Document for the SEPs, OU 4, DOE 1992*)].

Original Solar Evaporation Ponds

The original SEP, also known as Pond 2, was constructed in October 1953 on the existing grade; it measured approximately 200 feet by 200 feet by 6 feet. A clay dike was constructed around the perimeter, and the base of the pond was clay-lined. The operation of Pond 2 commenced in December 1953. Seeps were subsequently discovered along the northern, southern, and eastern dikes. Additional clay was added to the dikes as needed to repair the seeps.

In September 1955, a second earthen pond, designated as Pond 2-Auxiliary, measuring 100 feet by 200

[5] Leachate from the RFETS Present Sanitary Landfill was placed into the SEPs until January 1974 (Rockwell 1988). (Note: Present Landfill began operations in 1968 and shut down in 1997.) At this time, analysis indicated Phenol, Tritium, Strontium-90, Plutonium, Americium, Total Long-Lived (TLL) Alpha, and Nitrate to be present in the leachate (DOW 1974). All of these constituents have been included in historical sampling and analysis programs at the SEPs. Of these constituents, Phenol is the only RCRA constituent and it has never been identified as a potential contaminant of concern (PCOC) or COC for the SEPs.

[6] Although historical documents reference this waste code for arsenic, process knowledge and historical documentation also indicate that arsenic was not introduced into any plant process at RFETS.

[7] Although these specific constituents were not listed in the referenced report, the waste codes were identified. Based on the history of processes used at RFETS it is assumed that these are the applicable constituents associated with this waste code.

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Figure 2-1 Site Map with SEP area delineated.

Figure 2-2 Chronological History of Pond Construction, Operation, and Removal.

feet by 6 feet, was constructed to the southeast of Pond 2 to maintain operational capacity while plans for a new watertight pond were being finalized. *[NOTE: Pond 2-Auxiliary is referred to as Pond 2C in some documents.]* A weir was installed in the southeastern corner of Pond 2 to allow waste to overflow into Pond 2-Auxiliary. The new pond was unlined and leaks were observed along the eastern boundary within the first month of operation.

In August 1956, Ponds 2 and 2-Auxiliary were removed from service upon completion of the new watertight SEP (SEP 207-A). These ponds were allowed to dry so that a clay liner could be installed. Completion of the clay liner installation for Pond 2-Auxiliary and Pond 2 occurred in February and March 1957, respectively. The re-lined ponds were then returned to regular service.

A third clay-lined pond, Pond 2D, was constructed in April 1959 to contain any overflow from SEP 207-A and to support denitrification experiments. This third pond was located immediately east of Pond 2 as shown on Figure 2-2.

Routine use of Ponds 2, 2-Auxiliary, and 2D ceased in June 1960 when the B-Series SEPs were placed into service. The only other known discharge to these SEPs after June 1960 occurred in March 1963. During April of 1961, drainage tile was constructed east of the 207-B Ponds to collect and characterize leakage from the ponds. In July of 1961, construction activities were implemented to reline the drainage tile associated with 207-B center and 207-B North.

In October 1962, the Pond 2-Auxiliary area was regraded for the construction of Building 779. The clay lining and contaminated soils were removed and placed into one of the East Trenches at the RFETS. Soil samples collected from the bottom of Pond 2-Auxiliary showed activities of between 11,000 and 75,000 disintegrations per minute per kilogram.

The Pond 2 and Pond 2D areas were re-graded in 1970 to accommodate construction of SEP 207-C. The soils and dikes from these ponds may have been used in the construction of SEP 207-C. The approximate locations of the original solar evaporation ponds with respect to the existing SEPs are shown on Figure 2-2.

Table 2-1 summarizes this historical information regarding the original ponds. Detailed engineering drawings are presented in the *Closure Plan: Solar Evaporation Ponds*, Volume I, Appendix I (DOE, 1988), as well as the *Draft Operable Unit 4 Interim Measure/Interim Remedial Action Environmental Assessment Decision Document* (DOE, 1995).

Table 2-1 Solar Evaporation Pond Designations and Status (Source: DOE, 1992a.)

Current Designation	Original Designation	Date Completed	Current Status
Original Clay-Lined Solar Evaporation Pond	Pond 2	October 1953	Regraded in 1970 for construction of 207-C.
Pond 2 Auxiliary[a]	Pond 2 Auxiliary[b]	September 1955	Regraded in 1962 for construction of Building 779.
Pond 2D[a]	Pond 2D	April 1959	Regraded in 1970 for construction of 207-C.

[a] This pond could be confused with the original clay-lined solar evaporation pond since it was of earthen construction only.
[b] This pond was also known as Solar Evaporation Pond 2C. It was originally unlined, but was provided with a clay liner in January 1957.

SEP 207-A

SEP 207-A was placed into service in August 1956 to provide additional storage capacity. This pond was originally constructed with a liner consisting of asphalt planks approximately 0.5 inch thick, 3 feet wide, and 14 feet long. The pond measured approximately 250 by 525 feet at the crest with side slopes of 1:2. The maximum operating depth was approximately 7.5 feet, resulting in an impoundment volume of approximately 5 million gallons (DOE, 1988). This pond operated with a minimum freeboard of 2 feet. In September 1958, aluminum paint was applied to the exposed surface of SEP 207-A to increase evaporation.

In December 1959, drainage tile was installed along the eastern edge of SEP 207-A to intercept seeps discovered during the excavation of the 207-B SEPs. The drainage tile was connected to a sump located northeast of pond 207A, and a pump system was installed in April 1970 to return the collected water to SEP 207-A.

In November 1963, modifications were completed to correct problems associated with the liner cracking and slumping, which resulted in leakage of the pond contents. These modifications included replacing the asphalt planking with an asphalt concrete liner, changing the side slopes to 1:3.7, and regrading the base of the pond to drain to a sump at the northeastern end of the pond. The asphalt concrete liner consists of a 4-inch-thick aggregate base placed on top of the subgrade, overlain by an asphalt prime coat, 1.5 inches of asphalt concrete, an asphalt tack coat, 1.5 inches of asphalt concrete, and a catalytically-blown asphalt seal coat. Engineering drawings showing construction and liner details are presented in the *Closure Plan: Solar Evaporation Ponds* (DOE, 1988). (It is assumed this closure plan was never approved by the regulatory agencies, since approval documentation could not be located.)

In April 1964, a pump was installed at SEP 207-A to facilitate liquid transfer among the SEPs. In 1986, routine placement of waste in SEP 207-A ceased, and dewatering and sludge removal was initiated. Portland cement was mixed with the removed sludge to form pondcrete for offsite disposal. The last of the process water and sludge was removed from this SEP in July 1988.

To minimize the potential leakage of pond water to the underlying soil, the asphalt concrete side slopes of SEP 207-A were relined with a 1/8-inch (minimum) thick, rubberized, crack-sealing material in the fall of 1988.

By July 1988, the final process wastewater and sludges were removed from SEP 207-A by the pondcreting operation. From 1988 to 1992, a limited amount of precipitation and sediment collected in the SEP. In March 1990, approximately 1.3 million gallons of water were transferred from the 207-B SEPs to SEP 207-A to prevent the overflow of liquids. The transferred water was removed in the fall of 1992 prior to the commencement of the RFI/RI drilling program in December 1992.

SEPs 207-B North, Center and South

The 207-B Series SEPs (North, Center, and South) were placed into service in June 1960. These ponds were originally lined with asphalt planking approximately 0.5-inch thick, 3 feet wide, and 14 feet long. Each pond measures approximately 180 by 253 feet. The maximum operating depth for SEP 207-B South was 5.5 feet and 6.5 feet for SEPs 207-B Center and North, resulting in an impoundment volume of approximately 1.5 million gallons each.

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In June 1960, the transfer of waste from SEP 207-A to SEPs 207-B South and Center was initiated. These transferred wastes were acidic and produced gases which lifted the asphalt planking, thus rupturing the liner seams and resulting in leakage from the SEPs. Because of these problems, transfer operations were halted and the waste was returned to SEP 207-A. To return the waste to SEP 207-A, the waste had to be transferred to SEP 207-B North, which resulted in damage to all three of the 207-B Series SEPs. The asphalt planking within SEP 207-B South was covered with asphalt concrete in November 1960. The first six groundwater monitoring wells were installed in the vicinity of the 207-B Series SEPs in November 1960. Repair of SEPs 207-B Center and North was deferred because of funding limitations. SEP 207-B South was returned to service in December 1960.

In April 1961, repairs to the 207-B Series SEPs included installation of a drainage trench along their eastern edge. A sump and pump system was later installed in April 1970 to return the collected water to SEP 207-B North. SEPs 207-B Center and North were relined with asphalt concrete in July 1961. Because of difficulty in laying the asphalt concrete over the asphalt planking, the planking was removed from SEP 207-B North prior to it being relined with asphalt concrete. The two relined SEPs were then returned to service.

The placement of process waste into the 207-B Series SEPs ceased around 1974. A SEP clean-out program was initiated in 1974 and extended until 1977, when all process wastes were removed. Since 1977, the B-series SEPs were used to hold treated sanitary effluent, treated plant fire water, and brine from the Reverse Osmosis Facility, contaminated groundwater from the ITS, and treated wastewater generated during the June-July 1993 hot systems operations testing of the Building 910 evaporators.

In April 1967, an unsuccessful attempt was made to fill the cracks on the sidewalls of SEP 207-B North with asphalt mastic. In November 1967, sidewall cracks in SEP 207-B North were successfully repaired with burlap and asphalt. In October 1968, the sidewalls of SEP 207-B Center were successfully repaired with burlap and asphalt covering, and an additional coat of asphalt was applied to SEP 207-B North. Additional coats of burlap and asphalt were applied to SEPs 207-B North and 207-B Center in September 1969 and October 1969, respectively. The sidewalls of SEP 207-B South were covered with burlap and asphalt in September 1970. The sidewalls of SEPs 207-B North and Center were covered with Petromat® and hydraulic sealant in October 1971. The sidewalls and bottoms of SEPs 207-B South and 207-B North were relined with Petromat® and hydraulic sealant in October 1972 and September 1973, respectively.

In 1978, the Petromat® liners of SEPs 207-B Center and South were removed, bagged, and cemented for offsite disposal. The asphalt concrete liners were not removed. SEPs 207-B Center and South were then relined with a hydraulic sealant. In addition to the sealant, a synthetic 45-mil Hypalon® liner was installed in SEP 207-B South. A leak detection system was installed between the Hypalon® liner and the asphalt concrete liner. The leak detection sump is located in the northwestern portion of the SEP, and a pipe extends from the sump to the SEP berm. The lining of SEP 207-B North was not replaced because it held only a minimal amount of sludge, and its residual radioactivity levels were low. Engineering drawings showing the construction and liner details are presented in *the Closure Plan: Solar Evaporation Ponds* (DOE, 1988) (Note: This closure plan was never approved).

In April 1982, water was removed from SEPs 207-B Center and North for application to the West Spray Field. At the time of the spray field operations, SEP 207-B Center contained treated sanitary effluent and SEP 207-B North contained ITS water. The spray field operations ended in November 1985.

Between 1993 and 1995, wastewater and remaining sludge from ponds 207A and B-series was removed by the Accelerated Sludge Removal Project. The sludge was transferred to RCRA permitted tanks located on the 750 pad. This sludge was and is currently being shipped to Envirocare of Utah, Inc. for disposal.

SEP 207-C

SEP 207-C was put into service in December 1970 to provide additional process waste storage capacity and to provide interim storage for liquid from the other ponds during pond maintenance and repair work. SEP 207-C was constructed in approximately the same location as the original SEPs. This pond measures approximately 160 by 250 feet and has a maximum operating depth of 7 feet. The pond has an impoundment waste volume of 1.2 million gallons.

An asphalt concrete liner was originally installed in SEP 207-C, which consisted of a 4-inch aggregate base course, overlain by an asphalt prime coat, 1.5 inches of asphalt concrete, a second asphalt tack coat, 1.5 inches of asphalt concrete, an asphalt tack coat, and a surface of catalytically-blown asphalt seal coat. SEP 207-C has not been relined since its construction.

The bottom of the SEP slopes to the northeast. Design drawings indicate that a leak detection system was installed sometime in the late 1980s. The drawings depict the leak detection system as consisting of a perforated pipe aligned on a north-south axis under the F center of the pond with the pipe terminating in a sump at the northern end. Engineering drawings showing the construction and liner details are presented in the *Closure Plan: Solar Evaporation Ponds* (DOE, 1988). SEP 207-C has not received process wastes since 1986.

2.1.2 Actions Taken at the SEPs

Various activities and projects have been undertaken to remediate the SEPs and the SPP:

1. Relining and patching of the SEPs a number of times throughout the history of the ponds to control leakage (DOE 1992c).

2. Installation of drainage tiles between Pond 207A and Pond 207B, and east of Pond 207B in 1960 and 1961, respectively, to characterize water in the area (DOE 1992c).

3. Installation of two sumps and six trenches in the area north of the solar ponds to allow collection and return of contaminated groundwater to the ponds. The sumps were installed in April 1970 at the north end of the drainage tiles. Trenches 1 and 2 were installed in October 1971, Trench 3 in September 1972, Trenches 4 and 5 in April 1974, and Trench 6 in July 1974.(DOE 1992c).

4. Construction and utilization of the Interceptor Trench System (ITS) in 1981 to collect the surface water runoff and groundwater seepage [refer to *OU4—SEPs, IM/IRA Environmental Assessment Decision Document* (DOE, 1995)]. The ITS consisted of 18 french drains located on the hillside north of the SEPs and a surface water trench, known as the Interceptor Trench. The original configuration of this system has changed; refer to Item 4 below. Water collected by the ITS was pumped back uphill from the ITS Pumphouse near Walnut Creek into Pond 207-B North.

5. In 1986, a RCRA Part B operating permit application was submitted to the Colorado Department of Health (CDH)(renamed later as the Colorado Department of Public Health and Environment or

CDPHE). RFETS reported that the SEPs were an interim status unit scheduled to be closed. The SEPs including surrounding contamination were also identified as a Solid Waste Management Unit (SWMU), which later became IHSS 101. Figure 2-3 delineates the boundary of the SEPs RCRA regulated unit, as well as the boundary of IHSS 101. In 1991, under the requirements of the Interagency Agreement (IAG), individual hazardous substance sites were grouped into single management areas and the SEPs area or IHSS 101 also became designated as Operable Unit (OU) 4. IHSS 101 and OU 4 were also later designated as PAC 000-101 for reporting purposes under the HRR. Under RFCA in 1996, OU 4 was combined into the Industrial Area OU.

6. A number of environmental samples were collected from the vicinity of the SEPs in 1986, 1987 and 1989:

   - A program was initiated in 1986 that included the installation of 17 RCRA groundwater monitoring wells in the SEP area (designated with an 86 suffix) to expand the ability to monitor subsurface conditions related to the SEPs. Hydrogeologic tests were conducted in some of these wells. A draft RCRA Interim Status Closure Plan was submitted for the SEPs which summarized the testing results and outined a method for removing the SEPs from service;
   - Eighteen boreholes were drilled in 1987 in the SEPs area to acquire additional soil chemistry data specific to the SEPs (these boreholes are designated with an 87 suffix) and to respond to comments on the draft RCRA Interim Status Closure Plan submitted in 1986 that were directed in part to the collection of additional characterization data. Two of the boreholes were completed as wells for more groundwater monitoring capability and subsurface conditions were evaluated;
   - A draft closure plan was submitted in 1988 which detailed future characterization efforts; and
   - Thirty-seven monitoring wells (designated with a 89 suffix) were installed in 1989. These additional wells were drilled at locations identified as data gaps in the 1988 characterization.

7. In 1990, a draft Final Phase I RFI/RI Workplan for the SEPs, OU4 was prepared for the purpose of characterizing the physical features of OU 4, identifying potential contaminant sources, and to determine the distribution of contaminants in surface and subsurface soil. In 1992, both EPA and CDPHE granted approval of the workplan under the condition that a technical memorandum address vadose zone characterization at OU4 (CDPHE 1992). This technical memorandum (TM) No. 1 was written in 1992 and approved by both agencies in 1993. In 1993 TM No. 2 was written to document changes required to implement the workplan and was approved by both agencies in 1993 (CDPHE 1993).

8. During 1992, a brief investigation was performed to determine if the 207B-series ponds were leaking into the uppermost aquifer. This was accomplished by sampling wells in the vicinity of the SEPs for a dye that was placed in the SEPs. Based on the study, it was determined that no leakage was occurring from the 207B-series ponds.

9. Construction and utilization of the flash evaporation treatment system in Building 910, three temporary storage tanks and associated piping to contain and transfer water collected by the ITS, began in 1992. The modular storage tanks (MSTs) are located on the hill to the northwest of the SEPs and the ITS. The water from the MSTs was transferred to Building 374 for flash evaporation. Refer to the *Final Proposed IM/IRA Decision Document for the SEPs, OU 4* (DOE, 1992a). The MSTs are no longer used to contain ITS water; refer to Item 4 below.

10. Removal of liquid and sludge from the SEPs. The purpose of the removal efforts was to remove the source of nitrate and uranium contamination that exists in soils and groundwater beneath and adjacent to the SEPs. The removal (commenced in 1993 and was completed in 1995) provided access to the ponds for subsurface characterization work as described in the approved RCRA Facility Investigation/Remedial Investigation Work Plan (RFI/RI WP) for OU-4. The work was conducted as a routine operation within a RCRA Interim Status Unit Undergoing Closure. Following removal, the ponds were rinsed (with the possible exception of pond 207C, DOE 1995a) and the water pumped to Building 374 for evaporation. (Consistent with previous actions, pond 207C has been rinsed and precipitation removed as part of routine maintenance activities in 2002.) The remaining sludge, stored in the tanks on the 750 Pad, are in the process of being removed from the tanks, de-watered, packaged, and shipped to an offsite disposal facility. Refer to the *Draft Operable Unit 4 – Solar Evaporation Ponds Interim Measure/Interim Remedial Action, Environmental Assessment Decision Document* (DOE, 1995).

11. In 1993, investigations pursuant to the approved workplan and TM's were completed. The following investigations and sampling activities were performed:
    - A Ground Penetrating Radar (GPR) survey in the vicinity of the original ponds;
    - Six boreholes in or adjacent to the original ponds area were completed. Surficial and subsurface soil samples were collected at each borehole and analyzed for suspected contaminants;
    - A GPR survey was conducted beneath pond 207A;
    - An OU 4-wide beta/gamma radiation survey was conducted consisting of 311 data points;
    - A seismic refraction survey was completed to evaluate bedrock topography and the presence of paleochannels;
    - Twelve boreholes were completed and subsurface soil samples collected from within ponds 207A, 207B-Center and 207B-North;
    - Sixteen boreholes were completed between the ponds and around the perimeter of IHSS 101.
    - Nineteen boreholes were drilled and sampled in the ITS and surrounding area;
    - Twelve samples of asphaltic liner and sub-base material were collected from SEPs 207A, 207B-Center and 207B-North. (Note: Three additional samples were collected later from pond 207C later once the pond was emptied.);
    - One deep borehole (42193) within pond 207A was drilled into bedrock, sampled and geophysically logged. Subsurface samples were also collected;
    - Fifteen lysimeters were installed in the vicinity of IHSS 101;
    - 26 random and 10 discrete or "hot spot" surface soil samples were collected and surface soil samples were collected from 36 boreholes;
    - Approximately 200 subsurface soil samples were collected from the vadose zone;
    - Nine samples were collected for column leaching tests;
    - 25 soil samples were collected from boreholes for analysis of physical and hydogeologic properties;
    - Borehole permeability measurements were made;
    - Shallow soil permeability was measured at 19 locations using a Guelph permeameter;
    - Pore water samples were collected from lysimeters;
    - Relative moisture content in the vadose zone was measured using a neutron probe;
    - Data loggers and pressure transducers were installed in five wells to measure the response of water table to precipitation events and to evaluate responses attributable to secondary porosities; and
    - Soil gas samples were collected at 28 locations

12. As of March 1994, 87 percent of the RFI/RI data had been validated and 1.26 percent of the total validated data had been rejected. The DOE, CDPHE and EPA believed that enough validated data existed to assess and select a closure/remediation general response action and a proposed IM/IRA was written in 1995, which included a baseline risk assessment.

13. RFCA was signed in 1996 and based on the results of the RFI/RI investigation and the results of the risk assessment, ER ranked IHSS 101 number 14.

14. Installation of a reactive barrier (DOE 1999). The reactive barrier was installed in 1999 north of the SEPs on the northern side of the North Access Road. The barrier system consists of a collection system to direct groundwater flow to two passive treatment cells. The collection trench is approximately 1,100 feet long, two to three feet wide, and 20-30 feet deep. The trench extends about ten feet into the weathered bedrock to capture both bedrock and alluvial flow. The first treatment cell is filled with a mixture of organic media (sawdust) to act as a carbon source to induce denitrification and zero-valence iron to remove the uranium by chemical reduction. Nutrient mulch, which increases the denitrification rate, can also be added to the iron/sawdust treatment media. The second cell is filled with 100 percent granular activated iron aggregate to remove uranium. The collection trench cuts the ITS, allowing groundwater collected by the ITS upgradient from the reactive barrier to flow into the new collection trench. ITS lines were disrupted where they intersect the new collection system. The installation of a collection sump to increase the volume of groundwater treated was recently approved in the *Minor Modification to the Final Solar Ponds Plume Decision Document*, DOE 2002c.

15. Soil removal for purposes of reducing the long-term stewardship obligations of the SPP treatment system was not necessary since groundwater contaminants are below Tier II action levels in soil (see Section 3.1 for discussion). The groundwater plume under and downgradient of the SEPs is being addressed as part of the ongoing SPP IM/IRA (refer to the *Final Solar Ponds Plume Decision Document*, DOE 1999, and its Minor Modification, DOE 2002c).

16. Environmental monitoring, including downstream surface water and downgradient groundwater monitoring, is being conducted as part of the Site-wide Integrated Monitoring Program to ensure that contaminant concentrations are not increasing and that water quality standards are being met (refer to Integrated Monitoring Plan and the *Final Solar Ponds Plume Decision Document*, DOE 1999). This is being accomplished via a network of eight monitoring wells (four existing wells and four new wells; refer to the *Well Abandonment and Replacement Program, Work Plan Addendum for the Solar Evaporation Ponds*, July 2002, WARP-02.2-WPA, K-H 2002a). If contaminant concentrations increase, the Site will investigate and implement actions consistent with the overall risk and in accordance with RFCA Action Levels and Standards Framework (ALF).

17. Surface soil areas exceeding proposed soil action levels (October 2002) for Americium-241 and Plutonium 239/240 were removed under the ER RSOP Notification # 02-08.

These actions taken are consistent with the RFCA Vision for long-term stewardship in that source removal has been conducted and groundwater treatment has been implemented.

2.1.3 Current Status of the SEPs

The five ponds are situated on a large, level parcel of land, except where artificial berms have been built. The existing SEPs area covers approximately 6.1 acres [determined by Geographic Information System

(GIS) analysis, see risk assessment results in Appendix A] representing the boundary of the interim status RCRA regulated unit.

For purposes of addressing the SEPs and associated contamination under this PAM, IHSS 101 has been modified to exclude certain areas that will be included in other on-site investigations in the future:

- The "panhandle" area to the northwest and associated with Bowman's pond will be investigated as part of Bowman's Pond PAC 700-1108;
- The southwest corner of IHSS 101 and directly south of pond 207C currently includes several buildings (779, 780, 786,787 and others). This area will be investigated as part of under building contamination (UBC) 779 and the demolition or removal of these other buildings; and
- Directly east of the B-series ponds and PACs 900-1310 and 1314 is an area that is currently occupied by building 964 and represents IHSS's 176 and 165. This area will be investigated as part of IHSS 176 and 165.

The ground surface north of the SEPs slopes steeply downwards toward North Walnut Creek. The ponds are currently roped off and posted as contaminated areas, and all waste has been removed. They currently contain varying amounts of water from precipitation. The existing ponds and major pond components are shown in Figure 2-3.

Subsurface soils and any below-grade SEPs and OPWL components located in the area of Pond 2 Auxiliary will be addressed in the future as part of the UBC 779 (i.e., when UBC 779 is characterized and remediated as necessary).

Since the SEPs are a RCRA interim status unit and have both an IHSS and a PAC number associated with them, Table 2-2 identifies the required completion activity, mechanism for completion and the document used for completion.

Table 2-2 Completion Table I

Unit Name	RCRA Unit/IHSS/PAC	Required Completion Activity
Solar Evaporation Ponds	RCRA Interim Status Unit (no number), IHSS 101, and PAC 000-101.	RCRA Closure for RCRA Unit; and NFA for IHSS and PAC.

2.2 Other Units, PACs, and IHSSs

Process piping (above- and below-grade waste lines), manholes, electrical control conduit, other utilities, and associated piping support racks are present throughout the SEP area. South of 207-B South, there is a concrete ramp with metal grating for access into the SEP area. The ramp goes over the above-grade NPWL, electrical conduit, and associated support racks. Concrete "jersey" barriers are present to protect the above-grade NPWL. Detailed drawings of utilities, including a portion of the OPWL, valve pits and collection sumps, drainage tiles, and leak detection systems, are presented in the *Closure Plan: Solar Evaporation Pond*, Volume I, Appendix 1 (DOE, 1988). Also located in the area of the SEPs and within the IHSS 101 boundary is a MST line, RCRA Units 21 and 48, and PAC 900-1310. Figure 2-3 highlights these various units and each are discussed below since releases from these units may also have contributed to the contamination present around the SEPs.

In addition, there are several monitoring wells and lysimeters located in and around the ponds, inside and outside the bermed area.

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Figure 2-3 Solar Evaporation Ponds and Associated Components.

2.2.1 History

OPWL, NPWL, and MST Line

The OPWL functioned as a transfer and storage system for process waste from various facilities on-site to be treated at the process waste treatment facility housed in Building 774 and the Solar Evaporation Ponds. The OPWL is comprised of approximately 40 tank locations, which include an assortment of above-, on- and below-grade tanks; floor sumps; valve vaults; secondary containment structures and process waste vaults, with approximately 35,000 feet of pipeline. OPWL transported (or stored in OPWL tanks) various aqueous process waste containing low-level radioactive materials, nitrates, caustics, and acids. The waste managed in OPWL represents a subset of the total waste managed in the SEPs.

Some of the OPWL, including waste lines and valve vaults, are located in the SEP area, and some discharge into the ponds (refer to Figure 2-1). Other lines are used to transfer waste from one pond to another. Most of the lines were installed in the 1950s and 1960s and include P-26 (a portion of IHSS 149.1), P-35, P-36, P-37, P-38, P-48, P-49, and P-50. P-26 is constructed of stainless steel and PVC; P-36 and P-50 are constructed of stainless steel; P-35 is constructed of steel; P-37 is constructed of steel, PVC and vitrified clay; P-38 is constructed of vitrified clay; and P-48, and P-49 are constructed of cast iron. Some of these lines (i.e., P-26, P-36, P-37, and P- 38) have historically leaked and are part of IHSS 121. Refer to Operable Unit 9 Technical Memorandum No. 1, Volume IIA – Pipelines, Addendum to Phase I RFI/RI Work Plan, RFP/ER-TM1-93-OU9.2. (EG&G 1994)

Two other lines are located in the SEPs area. One of the lines is an aboveground line, which is part of the NPWL system and RCRA Unit # 374.3 that was used to convey water from the Modular Storage Tanks (MSTs) via Building 910 to Building 374. Typically the water transferred from Building 910 to Bldg. 374 did not contain RCRA contaminated wastewater. However, in 1999 a temporary authorization was received to transfer decant water from the 750 pad sludge removal project and cooling tower water from Building 779. The wastewater from the 750 pad project contained parts per billion (ppb) range of metals and parts per million (ppm) range of Methyl Ethyl Ketone. The cooling water from Bldg. 779 was contaminated with arsenic at 11 milligrams per liter (mg/L). Upon completion of the transfer of this waste to Bldg. 374, the transfer line was to be flushed, rinsed, and sampled and analyzed to ensure no residual contamination remained. However, documentation could not be located to ensure these final activities were conducted. There was no reported release from this line.

The other line located in the SEPs area and below grade, was used to convey water from the MSTs to Building 910. Water conveyed was primarily groundwater from the SEPs area collected by the ITS. There was no reported release from this line.

RCRA Units

Various structures associated with the removal and processing of pond sludge were located in between the ponds, after pond operations ceased; however, all structures have been removed, including Building 788, Trailer 788A, the 207 Clarifier unit, and the 308A Pumphouse (refer to Figure 2-3).

The Permacon within Building 788 was a RCRA permitted storage unit (RCRA Unit 21) used for the storage of pondcrete waste containers. The 207 Clarifier and the 308A Pumphouse were a RCRA interim

status unit (Unit 48) used to mix pond sludge and Portland cement to create "pondcrete". All that remain are concrete slabs, most of which are probably steel reinforced. Due to radiological concerns, the building and clarifier slabs have been covered with 80 mil plastic and soil. Partial closure was achieved for all of Unit 21 except for the former Permacon slab. The Permacon slab was rendered RCRA stable by decontamination using chemical cleaning and high-pressure spray methods. Partial closure was achieved for all of Unit 48 except for the 207 Clarifier and 308A Pumphouse slabs. The clarifier slab was rendered RCRA stable by the application of acrylic latex spray-on fixative. The pumphouse slab was rendered RCRA stable by chemical cleaning and high-pressure spray methods. Closure activities are summarized in Section 1.3 and detailed in the *Final Closeout Report, Building 788 and Clarifier Tank, RCRA Closure Decommissioning Project,* and *Summary Report of RCRA Closure Activities for Units 21 and 48 in Building 788* (RMRS, 1999). The estimated dimensions and areas of the slabs are presented below.

Location	Approximate Dimensions ft x ft	Approximate Area ft^2
B788/B788A Slab	220 x 22.5	4950
Former Permacon Area	47 x 10	470
207 Clarifier Slab	30 x 30	900
308A Pumphouse Slab	10 x 12	120

All structures associated with RCRA units 21 and 48 have been removed except for the facility pads (See RMRS 1999).

Potential Area of Concern (PACs)

There are four PACs associated with solar pond operations:

- 700-1113, associated with water released from Pond 207-C (refer to the Historical Release Report, Eleventh Quarterly Update, January 1, 1995 to March 31, 1995);
- 900-1310, associated with a spill from the Interceptor Trench System (ITS; refer to the Historical Release Report, Seventh Quarterly Update, January 1, 1994 to March 31, 1994);
- 900-1314, associated with sludge release from Pond 207-B (refer to the Historical Release Report, Ninth Quarterly Update, July 1, 1994 to September 30, 1994); and
- 900-1315, associated with a release from a tanker truck on the East Patrol Road, north of Spruce Avenue (refer to the Historical Release Report, Eleventh Quarterly Update, January 1, 1995 to March 31, 1995).

PACs 700-1113, 900-1314, and 900-1315 have been investigated, and based on results, no further action was proposed (refer to the Eleventh Quarterly Update, January 1, 1995 to March 31, 1995 for PACs 700-1113 and 900-1315, and the Ninth Quarterly Update, July 1, 1994 to September 30, 1994 for PAC 900-1314). CDPHE concurred with the no further action requests on 3/13/02.

PAC 1310 received approximately 490 gallons of water from the Interceptor Trench System (ITS) on November 30, 1992 when a pipe coupling in the 3" transfer line on the east slope of the 207-B North SEP berm separated during sub-zero weather. ITS water consists of collected groundwater from the SEP area. Contaminants of concern include uranium and nitrate. The pipe connection was repaired, and the system was placed back into service.

2.2.2 Actions Taken

Various activities and projects have been taken related to these other units in the area of the SEPs. A majority of these other units were removed recently as separate actions under ER RSOP for Routine Soil Remediation (ER RSOP; DOE 2002a) (refer to ER RSOP FY02 Notification #02-08; DOE 2002b). In addition, sampling was conducted in accordance with IA SAP Addendum 02-07 (DOE 2002d). The actions taken include:

1. ***A portion of OPWL and a portion of NPWL:*** Contaminated above-grade waste lines (NPWL), segments of below-grade lines located less than three feet below grade and within the berms (OPWL), valve vaults, collection sumps were removed, characterized and disposed in accordance with the ER RSOP. Soil contaminated by known releases (i.e., OPWL, valve vaults, and collection sumps) was removed if above RFCA Tier I action levels and disposed under the ER RSOP. Sampling around suspected areas identified soil contamination. For example, it is known that the valve vault west of Pond 207A leaked, and therefore, the area around the valve vault was investigated. Any soil removal included confirmatory sampling to ensure that all contaminated soil had been removed. Excavated soil was also characterized for waste management purposes. The leak detection line east of the B-series ponds and under pond 207C was disrupted and foamed in place.

2. ***MST Line:*** The MST line to Building 910 was disrupted in that the line was cut (disrupted) and filled with foam.

3. Removal of various structures associated with pond clean-out operations, including Building 788/788A, Trailer 788A, the 207 Clarifier unit, and the 308A Pumphouse. Part of Building 788A was a RCRA permitted unit (#21), and the clarifier and pumphouse were part of a RCRA interim status unit (#48). All that remain are concrete slabs. Partial closure was completed for the entire Unit 21 concrete slab except for the area of the former Permacon. The Permacon area was rendered RCRA stable by decontamination using chemical cleaning and high-pressure spray methods. Partial closure was completed for all of Unit 48 except for the 207 Clarifier and 308A Pumphouse slabs. The clarifier slab was rendered RCRA stable by the application of acrylic latex spray-on fixative. The pumphouse slab was rendered RCRA stable by chemical cleaning and high-pressure spray methods. Closure activities are presented in *Final Closeout Report, Building 788 and Clarifier Tank, RCRA Closure Decommissioning Project,* and *Summary Report of RCRA Closure Activities for Units 21 and 48 in Building 788* (RMRS, 1999).

4. ***RCRA Units 21 and 48:*** The concrete pads remaining for these units were removed and soil samples were collected beneath the concrete pads. Samples were analyzed in accordance with the IA SAP Addendum 02-07, indicating all detected contaminants were below RFCA Tier I ALs. Therefore, the remaining portions of these units were RCRA closed through removal.

5. ***PAC 900-1310:*** Potential Area of Concern (PAC) 900-1310 was sampled and characterized. Analytical results indicate radiological contaminants detected were all less than current RFCA Tier II ALs and metals were all less than current RFCA Tier II ALs except for arsenic which was below Tier I ALs (a maximum detected concentration of 17 milligram per kilogram (mg/kg) versus 2.99 mg/kg for Tier II). Nitrate and Nitrite were also well below current RFCA Tier II ALs.

6. Manholes, utilities and piping support racks, and concrete ramps and barriers were removed, characterized and disposed in accordance with the ER RSOP.

7. Unneeded monitoring wells were abandoned in accordance with applicable regulations under the Site's well abandonment program (i.e., P209089, P209489, 41693, 43893, 43993, 23795, 26095, 2786, 3887, 05093, 05193, and 05393) (Refer to the *Well Abandonment and Replacement Program, Work Plan Addendum for the Solar Evaporation Ponds*, July 2002, WARP-02.2-WPA, K-H 2002a). Lysimeters in the area were also removed.

2.2.3 Current Status

The other RCRA units were RCRA closed by removal and these closure activities will be documented in a final closeout report. All above ground lines, valve pits, sumps, pumps and associated equipment have been removed. All lines less than three feet below grade have also been removed. Lines greater than three feet below grade have been disrupted by cutting or disconnected and filled with foam. Soil has been sampled in areas around OPWL that are known to have leaked (e.g., around the valve pit) and with PAC 900-1310. Soil remaining around all these other units is below current RFCA Tier I ALs.

The B-series ponds are shown on drawings to have leak detection lines, however this was never determined based on field activities conducted under ER RSOP Notification 02-08.

Table 2-3 Completion Table II

Unit Name	RCRA Unit/IHSS/PAC	Required Completion Activity
Solar Evaporation Ponds	RCRA Interim Status Unit (no number), IHSS 101, and PAC 000-101.	RCRA Closure for RCRA Unit; and NFA for IHSS and PAC.
A portion of OPWL, sumps and valve pits	A portion of IHSS 121 and a portion of IHSS 149.1 (no PAC number)	NFA for IHSSs
A portion of NPWL[8]	A portion (Box 5 at Bldg. 910 to UBC 774 fence) of RCRA Unit 374.3 and PAC 000-504 (No IHSS number)	Partial RCRA Closure and NFA for PAC
MST line	No specific IHSS or PAC[9] reference	None
Permacon Concrete Pad	RCRA Permitted Unit # 21 (no IHSS or PAC number)	RCRA Closure
Clarifier and 308A pumphouse Concrete Pads	RCRA Interim Status Unit # 48 (no IHSS or PAC number)	RCRA Closure
ITS Water Spill	PAC 900-1310 (no IHSS number)	NFA for PAC

3.0 NATURE AND EXTENT OF CONTAMINATION

The source of groundwater and soil contamination within the SEPs IHSS was the process waste managed in the various units and ponds in this area. Contamination resulted from the leakage of the original and existing ponds, and releases from the OPWL and PAC 900-1310 (ITS Water Spill). Process waste has been removed from these units and shipped off-site for disposal. Refer to the latest version of the *Historical Release Report for the Rocky Flats Plant* (IHSS No. 101, Operable Unit 4, and IHSS No. 121,

[8] NPWL has multiple RCRA unit numbers associated with it. RCRA unit 374.3 only represents the portion of NPWL located within IHSS 101.
[9] This line could be associated with Interceptor Trench Pumphouse, PAC NE-1409, which received NFA approval in 2001.

Operable Unit 9); *Final Closeout Report, Building 788 and Clarifier Tank, RCRA Closure Decommissioning Project,* and *Summary Report of RCRA Closure Activities for Units 21 and 48 in Building 788* (RMRS, 1999); and *Historical Release Report Second Quarterly Update.* Previous investigations have been conducted to characterize the SEPs IHSS for purposes of defining the nature and extent of contamination. These investigations are detailed in the following:

- *OU4—Solar Evaporation Ponds, Interim Measure/Interim Remedial Action Environmental Assessment Decision Document,* U.S. DOE, RFETS, February, 1995 (DOE, 1995).
- *Final Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) Work Plan, OU4, SEPs,* RF/ER-94-00040, U.S. DOE, RFETS, September 1994 (DOE, 1994).
- *OU4 SEPs, Phase II Ground Water Investigation, Final Field Program Report,* ERM, February 1996 (ERM, 1996).
- *Management Plan for the ITS Water,* RF/ER-96-0031.UN, Rocky Mountain Remediation Services (RMRS, 1996).
- *SPP Remediation and ITS Water Treatment Study,* RF-RMRS-97-093.UN, Rocky Mountain Remediation Services (RMRS, 1997).
- *Final Phase I RFI/RI Work Plan, Original Process Waste Lines (Operable Unit 9),* U.S. DOE, RFETS, February 1992 (DOE, 1992b).
- *Solar Evaporation Pond 207C Characterization Report for the Rocky Flats Environmental Technology Site,* Rocky Mountain Remediation Services, December 1995 (RMRS, 1995).

Most waste lines, drain tiles, and leak detection lines should not have been a significant contributor to the contamination present within the IHSS. Process wastewater has drained to the collection sumps long ago and is no longer anticipated to be present in the lines. Also, it is assumed, based on visual inspection of lines and based on the composition of the lines, that contaminants did not penetrate or adhere to the construction materials of the lines to any significant degree. This is based on knowledge that stainless steel, steel, PVC, cast iron and vitrified clay[10] lines exist within this IHSS.

3.1 Groundwater Contamination

Groundwater contamination is discussed briefly for purposes of defining the nature and extent of contamination and to determine if additional soil remediation could reduce the long-term stewardship obligations of the Solar Ponds Plume (SPP) treatment system. However, corrective action of existing groundwater contamination, including treatment, is addressed in a separate Interim Measure/Interim Remedial Action (IM/IRA) decision document. (Refer to the Final Solar Ponds Plume Decision Document, DOE 1999, and its Minor Modification, DOE 2002c.)

From previous investigations and as documented in the Solar Ponds Plume (SPP) Decision Document (RMRS 1999c), it is known that the SPP is an area of groundwater contamination that extends from the SEPs to the northeast towards North Walnut Creek and to the southeast towards South Walnut Creek. It is contained within the upper hydrostratigraphic unit (UHSU). The primary contaminants in the plume

[10] Based on technical information associated with the manufacture of clay pipes/lines, when clay pipe is vitrified, the clay mineral particles become infused into an inert, chemically stable compound that is resistant to attack by various chemicals including acid and solvents (see the National Clay Pipe Institute @ www.ncpi.org.).

are various isotopes of uranium and nitrate (DOE, CDPHE, EPA, 1996). Performance monitoring wells for the SPP treatment system have also detected selenium, nickel and thallium[11] at concentrations above groundwater action levels. However, an analysis of metals distribution was conducted, and indicates that there is no metals groundwater plume associated with the SEPs.

Four monitoring wells (i.e., 1386, 1786, 70099 and 70299) are designated as performance monitoring wells in the SPP Decision Document, for the SPP treatment system to monitor the nitrate and uranium contaminated groundwater plume associated with the SEPs. Nitrate has declined over time at well 1786 and remained essentially unchanged at well 1386. Uranium concentrations (Uranium 233/234, Uranium 234) at well 1386 and well 1786 exceeded RFCA Tier II groundwater action levels during the Fourth Quarter of 2001 (Kaiser-Hill, 2002b).

Based on historical data, uranium and nitrate concentrations in surface soil and subsurface soil are all below RFCA Tier I and Tier II action levels. In addition, nickel and selenium are also below Tier I and Tier II action levels in both surface and subsurface soil. Therefore, no additional soil removal is required for purposes of reducing the long-term stewardship obligations of the SPP treatment system.

The current Solar Ponds Plume collection and treatment system was installed as an Interim Measure/Interim Remedial Action (IM/IRA) and placed into operation in 1999. This new system replaced the previous Temporary Modular Storage Tanks storage and B-374 evaporation treatment systems. The SPP system collects water from an 1,100 foot long trench that primarily collects water from the pre-existing Interceptor Trench System (ITS), passes it through two treatment cells containing iron filings (to remove uranium) and wood chips to biologically reduce the nitrates, and discharges to a gallery near Walnut Creek. A minor modification to the 1999 IM/IRA was submitted and approved by the regulatory agencies this year Fiscal Year (FY) 02, to increase the amount of water treated by the treatment system by installing a collection sump in the existing collection trench and pumping groundwater into the existing treatment cell.

3.2 Soil Contamination

Extensive historical data from analysis of surface and subsurface soil from the SEPs area were collected, quantified, and were originally stored in electronic format in the RFETS environmental Soil Water Database (SWD). The sampling and analytical programs followed approved work plans, and chemical analytical results were validated in accordance with EPA and RFETS data validation guidelines. All contaminants detected are considered Potential Contaminants of Concern (PCOCs).

In addition, characterization data that was obtained based upon actions conducted under the ER RSOP such as confirmation samples collected after the removal of sumps, will be included in the closeout report and will not be included in this PAM.

[11] The maximum detected concentration in subsurface soil is 4.2 mg/kg and the maximum detected background concentration for Thallium is 4.1 mg/kg. Current RFCA ALF does not identify an action level for Thallium in surface or subsurface soil. Proposed surface soil Preliminary Remediation Goals (PRGs) do not include Thallium as a contaminant. Historical knowledge does not indicate Thallium was used in processes, which were discharged to the SEPs.

3.2.1 Surface Soil Contamination

Surface soil contaminants include metals, nitrates and radionuclides. The distribution of these contaminants on the SEP berms and nearby indicates that surficial contamination may have resulted primarily from aerosol dispersion of SEP liquids or SEP overtopping. The drainage tile between SEP 207-A and the 207-B SEPs appears to have discharged contaminants to the hillside north of the SEPs. The occasional incidence of elevated metals in the seep areas north of the SEPs were attributed most likely to the local accumulation of metals transported in groundwater that discharges to the ground surfaces. The sporadic distribution of SVOCs in surficial soil and their absence in vadose zone soils suggests that these contaminants are not related to waste management practices at the SEPs. The SEPs have been lined and relined on several occasions with asphaltic material, and the staging of asphaltic construction materials or operation of a "hot-mix" batch plant may have contributed to the isolated sources of polycyclic aromatic hydrocarbon contamination. In addition, the distribution of PCB arochlor-1254 does not display a pattern consistent with contamination migration from the SEPs. Refer to *OU4—Solar Evaporation Ponds, Interim Measure/Interim Remedial Action Environmental Assessment Decision Document*, Part II, Volume 1, Section 4, U.S. DOE, RFETS, February, 1995 (DOE, 1995).

All concentrations of contaminants are below RFCA Tier I.

3.2.2 Subsurface Soil Contamination

Subsurface contaminants include metals, VOCs, radionuclides, and nitrates. The extent of metals contamination in the subsurface was more limited than in the surficial soils, however, the general distribution was similar. Metal contaminants occurred predominantly in the immediate vicinity of and beneath the SEPs. With the exception of barium and zinc, concentrations of metal contaminants generally decreased with depth. The distribution of metals in the subsurface indicates that metals entered the vadose zone from SEP liner breaches and were subsequently sorbed onto the soil matrix. Elevated metal concentrations also occurred at the outfall of the drainage tile on the hillside north of the SEPs. (Refer to DOE, 1995)

Toluene, acetone and methylene chloride were the only VOCs detected at significant frequencies. Although toluene was frequently detected, the results of the duplicate sample evaluation indicate that the analyses for toluene were not accurate and precise. The pervasive distribution of toluene in the subsurface at low levels indicates that external factors, such as cross-contamination during sampling or analysis, may have been responsible for the identification of toluene in samples. Acetone and methylene chloride were detected in equipment rinsate and laboratory blanks, which also suggests that these VOCs were introduced during sampling and laboratory activities. (Refer to DOE, 1995).

The distribution of radionuclides beneath the SEPs indicates that concentration levels generally decreased with depth. With the exception of uranium-233/235, uranium-238, gross beta radiation sources, and tritium, the presence of radionuclide contaminants is generally restricted to areas beneath the SEPs and the drainage tile outfall area north of SEP 207-A and SEP 207-B North. The exceptions listed are found beneath the SEPs, and north, downgradient of the SEPs at seeps within the former Protected Area (PA) and further downslope (north) of the former PA in the buffer zone. (Refer to DOE, 1995).

The distribution of nitrate in the subsurface suggests that nitrate has a distribution pattern similar to that of tritium and that concentrations decrease with depth. Cyanide is present beneath SEP 207-A, north of

the drainage tile outfall area, and north of SEP 207-C at shallow depths (0 to 6 feet). Cyanide is also found pervasively throughout the vadose zone beneath the northeastern portion of SEP 207-B North, and at depth (greater than 12 feet) northeast of the SEPs in the buffer zone. (Refer to DOE, 1995).

All concentrations of contaminants are below RFCA Tier I action levels.

3.3 Liner Contamination

Fifteen pond liner material grab samples were collected as part of the OU4 Phase I RFI/RI activities conducted in 1993 and summarized in the 1995 proposed IM/IRA Decision Document for OU 4. Six samples were collected from pond 207-A, and three samples from each pond 207B-North, 207B-Center and 207C. These pond liner material samples were submitted for determination of Target Analyte List (TAL) metals and radiochemical analytes. Cyanide analysis was also included for ponds 207B-North and Center. Four additional samples were collected in Pond 207C and analyzed for metals using the Toxicity Characteristic Leaching Procedure (TCLP).

Organic analysis was not conducted on the samples collected from the liner material, since the matrix of the material (asphalt) would interfere significantly with the method of analysis resulting in extremely high detection limits and data that can not be interpreted. The overall concentration of organic contaminants, which may be present in the liner material would be significantly less compared to the concentration of the matrix material. Therefore, since the ponds managed low concentration of organics in the wastewater and sludge, the ponds were designed to evaporate, and asphalt is an impermeable material, it is conservatively assumed that the concentration of organics detected in subsurface soil (more absorbent than asphalt) is representative of the liner material as well. It is also noted, that solvents and other organics were not reported to have been routinely discharged to the SEPs (DOE, 1995).

Metals and radionuclides were detected in the liner material samples. The highest concentration of metals was detected in ponds 207A (Cadmium and Lead) and 207C (Arsenic). Ponds 207A and pond 207C historically managed waste with higher concentration of contaminants. However, the TCLP results for the liner material from pond 207C indicate all RCRA metals are below regulatory limits and therefore the liner material is not a characteristic hazardous waste due to the presence of metals. These TCLP results are considered representative of all the ponds based on a review of all the pond liner material data, the historical use of the ponds and a review of historical data associated with wastewater and sludge managed in the ponds.

4.0 FUTURE LAND USE

The conceptual land use for the IHSS 101 area of concern as shown in RFCA Attachment 5, Figure 1, is a capped area and monitored retrievable storage, surrounded by a larger restricted open space area. Future on-site land use at RFETS includes environmental restoration, decontamination and decommissioning, and transfer of jurisdiction to the U.S. Fish and Wildlife Service for use as a wildlife refuge, in accordance with the Rocky Flats National Wildlife Refuge Act of 2001. The refuge is currently envisioned to have minimal maintenance following remediation, but wildlife refuge workers (WRW) are assumed to be present onsite for most of the year and engaged in refuge maintenance and ecological work activities. Ecological surveys performed in compliance with the Threatened and Endangered Species Act indicate the presence of habitat that is potentially suitable for protected plant and animal species, such as Prebles Meadow Jumping Mouse. Because of the conceptual land use, residential development is not considered a foreseeable future land use scenario and was not included in the risk assessment.

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5.0 EVALUATION OF RISKS

A Human Health Risk Assessment (HHRA) is presented in Appendix A to this document. The HHRA estimated health risks for the WRW onsite receptors that could be exposed to Contaminants of Concern (COCs) at the SEPs Area of Concern (AOC). The AOC covered by the data evaluation and risk assessment is shown in Appendix A, Figure 1.1, and covers approximately 33 acres. The AOC was defined to include the modified IHSS 101 as well as an additional area to the south and north based on existing analytical data. Exposure media evaluated were surface soil, subsurface soil, pond liner material and outdoor air.

Extensive historical data from analysis of surface and subsurface soil, and pond liner material from the SEPs area were collected, quantified, screened and then used to select COCs for a risk assessment. (See Appendix A for a description of the screening process.) These data[12] were filtered and screened to ensure usability for risk assessment purposes. All contaminants detected are considered Potential Contaminants of Concern (PCOCs). PCOCs were screened relative to Preliminary Remediation Goals (PRGs) for an on-site WRW exposure scenario set to a 1E-06 risk level and a hazard quotient of 0.1, since the target risk level is 1E-05 and this ensures that cumulative effects of PCOCs will be taken into consideration. Based on the risk assessment (Appendix A), the following COCs were identified:

Surface Soil	Liner Material	Subsurface Soil
Cadmium	Americium-241	Cadmium
Chromium	Uranium-235	Americium-241
Americium-241		Plutonium-239/240
Plutonium-239/240		Uranium-234
Uranium-234		Uranium-235
Uranium-235		Uranium-238
Uranium-238		

Americium-241, Plutonium-239/240, and Uranium-235 in surface soils are the largest contributors to risk. A complete set of the data used in the risk assessment and an evaluation of the data are presented in Appendix A.

Results of the risk assessment indicate cumulative Hazard Index (HI) for non-carcinogenic health effects for RCRA constituents were well below 1.0 at 0.04 for reasonable maximum exposure (RME) conditions. No adverse non-cancer health effects are expected, even for sensitive individuals, because hazard indexes are less than 1.0 for both exposure scenarios. Therefore, no action is warranted due to non-carcinogenic effects.

The total cancer risk to the WRW due to RCRA constituents is 3E-07 and 2E-06 for radionuclides. Therefore, based on achieving protective media cleanup standard for human health at 1E-05 risk for a WRW, no action is necessary for either RCRA or radionuclide COCs due to carcinogenic effects.

Specific to the liner material, the risk assessment identified only radionuclides as COCs. Since the concentration of all metals in the liner material and the concentration of organics present in the subsurface soil (conservatively assumed to be representative of the liner material) were screened to

[12] Data collected in 2002 as a result of the activities identified under ER RSOP notification 02-08 and IA SAP Addendum 02-07 was not included in the data set used in the risk assessment.

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below 1E-06 to a WRW scenario, the liner material is determined not to be contaminated with hazardous waste.

6.0 CONCLUSIONS

Based upon the current condition of the SEPs area and from previous actions taken:

- The source of the SPP contamination was the waste managed in the ponds and the waste has been removed from the ponds;
- Groundwater contamination is being treated and is addressed under a separate IM/IRA;
- Groundwater contaminants that are also present in soil are all below current RFCA Tier II ALs;
- Liner material determined not to be contaminated with hazardous waste and is not a characteristic hazardous waste;
- Total carcinogenic risk to a WRW for RCRA constituents is 3E-07 and for radiological contaminants is 2E-06;
- HI for non-carcinogenic effects are less than 1.0;
- Other RCRA units in the SEPs area have been closed by removal; and
- All above-ground structures including sumps, valve pits, and lines less than 3 feet have been removed.

In addition, but separate from RCRA closure, the radiological contaminants have also been determined to be below RFCA Tier I action levels and below proposed soil action levels (October 2002), therefore under CERCLA, no additional action is required for these contaminants.

6.1 RCRA Closure

This section focuses only on RCRA constituents for purposes of demonstrating closure of the SEPs and the entire AOC. The alternative closure requirements have been defined as:

- Achieve protective media cleanup standard for human health at 10-5 risk for a WRW; and
- Comply with the closure performance standard in 6 CCR 1007-3, 265.111(a) and (b).

As previously discussed, the results of the risk assessment indicate that for RCRA constituents the total cancer risk to the WRW is 3E-07, which are both well below the closure requirement of 1E-05 for a WRW.

The closure performance standard of 6 CCR 1007-3, Section 265.111 (a) and (b) is defined as:

- Minimizes the need for further maintenance; and
- Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.

Therefore, in order to demonstrate compliance with this closure performance standard, the following sections discuss each of these requirements.

Minimize the Need for Further Maintenance

No further maintenance of the SEPs AOC is required for the following reasons:

- The concrete pads associated with RCRA Units 21 and 48 were closed by removal;
- Contaminated soils beneath the concrete pads associated with RCRA Units 21 and 48 were removed;
- Segments of the OPWL, valve vaults associated with the OPWL, and collection sumps associated with drainage tiles and the leak detection system were removed;
- Contaminated soils around the OPWL, valve vaults, and collection sumps were removed;
- Contaminated soils from PAC 900-1310 were removed;
- Soil removal was not necessary for purposes of reducing the long-term stewardship obligations of the SPP treatment system;
- No leachate is being generated from the current SEPs configuration;.
- The SEPs liner material at the surface, as they exist now, does not contribute to risk;
- All surface and subsurface soil contaminants are below RFCA Tier I action levels; and
- The total cancer risk to the WRW due to RCRA constituents is 3E-07, which are well below target risk of 1E-05 for a foreseeable land use WRW scenario.

Post-Closure Escape of Hazardous Waste

Since the source of contamination associated with the SEPs (i.e., the wastewater and sludge) has been removed, the post-closure escape of hazardous waste has been eliminated. In addition, both the liner material and surrounding soil are determined not to be contaminated with hazardous waste since the resultant risk is below the target risk of 1E-05 for a WRW scenario. In addition, the liner material does not exhibit the toxicity characteristic for D004-D011 metals and it is not considered a D001, D002, or D003 hazardous waste.

Post-Closure Escape of Hazardous Constituents

Since the source of hazardous waste has been removed, and both the liner material and soil are not contaminated with hazardous waste, post-closure escape of hazardous constituents do not present a situation adverse to the long-term protection of human health and the environment.

Post-Closure Escape of Leachate

Since all hazardous waste has been removed, and remaining constituents are below risk-based levels, the post-closure escape of leachate has been minimized. Currently no leachate exists from the SEPs.

Post-Closure Escape of Contaminated Run-off

Both the liner material and soil have been determined to not be contaminated with hazardous waste. Therefore, the post-closure escape of contaminated run-off has been minimized.

Post-Closure Escape of Hazardous Waste Decomposition Products

Since all hazardous waste has been removed, and since the liner material and remaining soil have been determined not to be contaminated with hazardous waste, the post-closure escape of hazardous waste decomposition products has been minimized.

This PAM is proposing a no further action designation for the SEPs AOC, since the SEPs meet the alternative RCRA closure requirements by achieving acceptable residual risk for a WRW and complying with the closure performance standard in 6 CCR 1007-3, 265.111(a) and (b).

6.2 IHSS 101

Without additional remedial action, the SEPs area, including IHSS 101, is protective of human health and the environment since the total carcinogenic risk to a WRW for RCRA constituents is 3E-07 and for radiological contaminants is 2E-06. The hazard index for non-carcinogenic effects is less than 1.0. In addition, all surface and subsurface soil contaminants are below 2000 RFCA Tier I action levels for open space; all surface and subsurface soil contaminants are below 2002 proposed RFCA action levels resulting in a lifetime excess cancer risk of $1x10^{-5}$ to a wildlife refuge worker. Consequently, no further remedial action is required for IHSS 101.

6.3 Summary

Table 6-1 Completion Table III

Unit Name	RCRA Unit/IHSS/PAC	Required Completion Activity	Mechanism For Completion	Completion Documentation
Solar Evaporation Ponds	RCRA Interim Status Unit (no number), IHSS 101, and PAC 000-101.	RCRA Closure for RCRA Unit; and NFA for IHSS and PAC.	RCRA Closure using alternative closure requirements, achieving 10^{-5} risk to a WRW for RCRA constituents. NFA determination for remaining contaminants using RFCA Tier I ALs, achieving 10^{-5} risk to a WRW and below proposed soil action levels (October 2002).	PAM and HRR
A portion of OPWL, sumps and valve pits	A portion of IHSS 121 and a portion of IHSS 149.1 (no PAC number)	NFA for IHSSs	A portion of the line was removed, remaining lines are > 3' below grade, and soils in areas of know releases are below RFCA Tier I ALs.	Closeout Report and HRR for IHSS and PACs
A portion of NPWL[13]	A portion (Box 5 at Bldg. 910 to UBC 774 fence) of RCRA Unit 374.3 and PAC 000-504 (No IHSS number)	Partial RCRA Closure and NFA for PAC	RCRA closure by removal of the aboveground line.	
MST line	No specific IHSS or PAC[14] reference	None	NA	

[13] NPWL has multiple RCRA unit numbers associated with it. RCRA unit 374.3 only represents the portion of NPWL located within IHSS 101.

[14] This line could be associated with Interceptor Trench Pumphouse, PAC NE-1409, which received NFA approval in 2001.

Unit Name	RCRA Unit/IHSS/PAC	Required Completion Activity	Mechanism For Completion	Completion Documentation
Permacon Concrete Pad	RCRA Permitted Unit # 21 (no IHSS or PAC number)	RCRA Closure	RCRA closure by removal of the concrete pad and soil to RFCA Tier I ALs.	
Clarifier and 308A pumphouse Concrete Pads	RCRA Interim Status Unit # 48 (no IHSS or PAC number)	RCRA Closure	RCRA closure by removal of concrete pads and soil to RFCA Tier I ALs.	
ITS Water Spill	PAC 900-1310 (no IHSS number)	NFA for PAC	Soil to RFCA Tier I ALs. (Recent analytical results indicate rads, Nitrate/Nitrite & metals < Tier II ALs, except arsenic < Tier I ALs.)	
Entire Area considered SEPs AOC			• Risk at 10-5 to a WRW for all contaminants; • Radiological contaminants are below RFCA Tier I ALs; • Groundwater contaminants that are also in soil are below Tier II soil ALs; and • Remaining contaminants are below proposed soil ALs (October 2002).	PAM

7.0 ENVIRONMENTAL IMPACTS

Paragraph 95 of RFCA specifies that National Environmental Policy Act (NEPA) values will be included in RFETS decision documents (DOE, CDPHE, EPA 1996). While environmental consequences are addressed in part throughout the decision document, this section of the document specifically examines environmental impacts and satisfies the RFCA requirement for a NEPA-equivalent assessment.

In general, this PAM demonstrates that the SEPs can be left in their current condition without presenting an unacceptable risk to human health and safety or the environment. Closure of the SEPs, without implementing BMPs such as leveling the berms and ponds, will not affect or will have very minor effects on air quality, ground water, ecological resources, soils and geology, and human health and safety. The visual appearance of the SEPs will not match the appearance of a native grassland, and re-establishment and maintenance of native vegetation may be more difficult than a contoured surface, but these effects would not be significant. Surface water will collect in the SEPs after rains or snowfall; generally, the collected water will evaporate. While sampling of water in 207A demonstrates that most parameters will pass surface water standards, if activities are planned in or around the SEPs, surface waters will be removed and managed per existing Site procedures (e.g., for incidental water).

Implementation of BMPs will have more notable impacts, which will be both beneficial and adverse. In most aspects, the impacts will be positive and lasting. Positive impacts will occur by reducing or eliminating movement of and exposure to residual contaminants from the SEPs, by increasing wildlife

habitat, and through an improvement in the appearance of the area. Adverse impacts are limited to temporary effects, such as increased air emissions from the use of heavy equipment, potential erosion during remedial activities, and increased risks to safety during remedial operations. Both social and environmental impacts associated with the BMPs are considered. The following sections discuss the impacts from the BMPS; some issues are briefly discussed in the following paragraphs only.

The SEP project does not affect compliance with the Historic Preservation Act of 1966. Since the project area has been disturbed previously, and the most of the subsurface will not be further disturbed, the discovery of archeological or historic artifacts is very unlikely. If such artifacts are encountered, work will be stopped and appropriate RFETS procedures will be followed.

Equipment used and dust generated during the BMP activities will be visible temporarily, and dust control measures, such as watering, will be used as needed. Long-term, reclamation of the area will provide a more natural appearing landscape. Noise levels will be temporarily elevated during BMP activities, but are not expected to exceed levels commonly encountered during highway construction projects. Sensitive human receptors are not found near the SEPs; therefore, noise is not a concern.

In accordance with Executive Order 12898, potential impacts on minority and low-income populations is considered. The activities will occur onsite away from inhabited areas, and will not lead to offsite indirect effects on nearby populations. Disproportionately high and adverse human health or environmental effects will not be imposed on these populations. The BMP activities will provide short-term employment for a limited number of people (less than one percent of currently employed RFETS personnel), and socioeconomic effects of the activities will be minimal.

Air Quality

Implementation of the BMP will impact air quality, however the impacts to air quality will be temporary, and will primarily occur from the operation of construction equipment. Fugitive dust, including total suspended particulate (TSP) and particulate matter less than ten micrometers in aerodynamic diameter (PM_{10}), is of greatest interest.

Fugitive dust emissions are estimated by identifying the types and capacities of the construction equipment to be used, duration of activities, the area or volume of soil to be disturbed, travel distances, environmental conditions, and use of an emission factor for each category of operations. The estimates use factors and equations for estimating emissions from the USEPA's *A Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, Volumes 1 and 2.*

Fugitive dust emissions were estimated using factors for bulldozers, graders, and scrapers for the purpose of moving berms and importing 35,000 cubic yards of soil. The work includes contouring the entire site, and is estimated to last for six weeks at 40 hours per week.

Total projected emissions are 5.5 tons of TSP, and 2.3 tons of PM_{10} (AQM, 2002). The fugitive dust quantities are total amounts for the entire project. Most fugitive dust emissions will drop back to the ground at the SEPs. The fugitive dust will include several non-radiological components that are specifically estimated. The following emissions are in pounds, and are total amounts for entire project on an annual basis: arsenic (6E-03); cadmium (3E-01); chromium (10E-02); and manganese (6E+00). Monitoring these emissions is conducted at a specified level of concern of 250 pounds per year; therefore, these emissions are not significant.

Radiological emissions are based on the initial surface soil screening. The modeled result for the SEP activities is 2.9E-03 mrem per year effective dose equivalent (EDE) to the maximally exposed individual (person most greatly impacted by the activities). The modeled EDE is well below the threshold monitoring level of 0.1 mrem per year, and radiological emissions are not significant.

Surface Water

The SEPs are situated on a level area and cover about six acres. The entire SEPs AOC covers about 33 acres. Surface water consists of small amounts of water in the SEPs; water in the SEPs will be removed prior to the berms being pushed in. Surface water concerns are related to runoff and the effects on nearby drainages.

During the contouring of the area, soil can be transported by runoff from precipitation events. The ground surface north of the SEPs slopes steeply downwards toward North Walnut Creek, but surface water flow is intercepted by open channels and storm water culverts.

Surface water monitoring will be conducted as part of the Site-wide Integrated Monitoring Program to ensure that contaminant concentrations are not increasing, and that water quality standards are met.

Groundwater

Groundwater quality in the area of the SEPs will be not be directly affected by BMP activities. Groundwater is not directly addressed by this PAM; remedial actions for groundwater are considered in other plans. For example, the groundwater plume under and downgradient of the SEPs is being addressed as part of the ongoing SPP IM/IRA.

The long-term indirect effect of the BMPs will be to direct water away from the area of the SEPs, and to allow greater volumes of water to be captured by plants growing on the site and released through the evapotranspiration process.

Ecological Resources

As currently configured the SEPs have little ecological value, and activities to cover and contour the SEPs will have little short-term impact on ecological resources. The finished site will provide 33 acres of revegetated open space that will have value for small mammals, songbirds, and similar species. The ecological value of the SEP area should increase over time, as the surrounding area is also revegetated, and animal species are better able to use the site. The area is to be revegetated with native plant species, which will be beneficial, but adverse impacts could occur if weed species are allowed to infest the area. The controls to ensure that a natural vegetative cover is established, and weed growth prevented, is to be identified and implemented in the Final Site Corrective Action Document (CAD)/Record of Decision (ROD).

Soil and Geology

The ponds will be filled with material from the berms (material originally excavated from the site) and additional soil brought in as fill and topsoil. Contaminated soil within the SEPs was removed prior to implementing the BMP. Removal of contaminated soil will benefit the area as a whole. The use of

mixed soil to change the area from an industrial pond use to a more natural prairie setting will also be beneficial in terms of soil and soil productivity, in the remediated SEP area.

In the borrow site east of the ponds, where fill materials will be obtained, surface soil will be removed and soil productivity will be reduced.

Subsurface geological resources would not be affected. Prime or unique farmlands would not be affected.

Human Health and Safety

The closure of the SEPs is being approached in a holistic manner that identifies and evaluates cumulative risks to human health and safety. To ensure protection of human health and the environment, a risk assessment was performed based on COCs within the AOC. In particular, this PAM reviews the long-term risk to a hypothetical most exposed person (i.e., a future WRW). Short-term construction activities, which can pose a direct risk of injury to workers, are also evaluated in this PAM.

BMP activities in the area of the SEPs are comparable to typical construction activities (e.g., operation of heavy equipment); unique or unusual activities are not associated with the closure. The activities will be short-term, lasting from days to months, and will pose safety risks for workers that are similar to other demolition and construction operations. These risks are addressed through various controls required at the Site. For example, a project-specific Health and Safety Plan (HASP) will address the entire scope of the project. As a part of the HASP, a Job Hazard Analyses (JHA) will be prepared that will address each task, the hazards associated with that task, and the controls (e.g., the use of PPE) needed to minimize the risk inherent in that task. These controls and focus on safety minimize the short-term risk associated with the project.

The long-term health and safety risk associated with the closed SEPs is the focus of this document. As a primary requirement to closing the SEPs, this document looks at future risks to a hypothetical most highly impacted person (i.e., WRW). The risks are based on an evaluation of COCs, which could have non-carcinogenic and carcinogenic effects on WRWs. This conservative approach, bounds the maximum impact for off-Site receptors or future visitors, since the risks to a WRW will be much higher than to any other person.
Non-radiological health effects from exposure to chemicals are measured by a hazard index (HI). An HI greater than one is considered to be a basis for concern. The risk assessment in this PAM finds that the HI for non-carcinogenic health effects is well below 1 (0.04). The total cancer risk to a WRW, due to exposure to RCRA constituents left at the SEPs, is below one excess cancer case per one million exposed individuals (4E-07), and the total cancer risk to a WRW due to radionuclides (principally americium-241 and uranium-238) is 3E-06. These risks are well below the RCRA closure requirements for non-radiological contaminants and below the RFCA Tier I action levels for radiological contaminants. Therefore, potential impact to the long-term health and safety of WRW (and other persons) is insignificant.

Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resources are resources that are consumed, committed, or lost. Activities discussed in the PAM will irreversibly and irretrievably use or commit resources, but will not result in a significant loss of resources. Committed resources include the consumptive use of geologic resources and fuel use during construction activities. Fill, clay, sand, and gravel will be needed; the proposed

approach requires a permanent commitment of about 35,000 cubic yards of these materials. Adequate supplies are available locally without affecting local demand for these products. Fuel will be consumed by construction equipment and vehicles performing the construction, and will not be recovered.

Cumulative Impacts

Cumulative impacts may result from the combination of incremental impacts from past, present, and reasonably foreseeable future actions. Cumulative impacts could have the potential of being more significant than the individual impacts due to synergism between types and areas of impacts or the individual impacts collectively resulting in significant effects to the environment.

The *Rocky Flats Environmental Technology Site Cumulative Impacts Document* (CID) (DOE, 1997) provides a broad-scope environmental impact analysis of activities planned to achieve the current RFETS mission of site cleanup and closure. Environmental issues related to closure in general are addressed in that document. Specific activities, such as the remediation of the SEPs, may have cumulative effects, although at this time, there are no other activities planned in the vicinity of the SEPs that are expected to have significant cumulative environmental impacts.

Likely activities that would occur in the vicinity of the SEPs would include the removal of SEP components. Removals would include, for example, contaminated facility slabs, above-grade waste lines, valve vaults, collection sumps, manholes, utilities and support racks, concrete ramps and barriers, soil contaminated by known releases (i.e., OPWL, valve vaults, and collection sumps), unneeded groundwater monitoring wells, and lysimeters. Decommissioning and demolition activities throughout the Site would continue, and trucking of wastes and materials would be cumulative with the SEP closure.

The following types of cumulative impacts may occur:

- Implementing the BMP means that about 35,000 cubic yards of soil will be brought into this area. While the traffic generated by the project will occur at the same time as other activities, the vehicle travel will occur on RFETS, and the impact will be temporary and not significant.
- Water erosion of the SEPs berms could occur if substantial rainfall occurs during remedial activities; other projects with exposed soil would also be eroded. Given the generally flat area of the SEPs, and mandatory erosion controls at RFETS, significant cumulative erosion would not be expected.
- Along with the rest of the industrial area, the revegetated SEPs will provide additional habitat for wildlife. The effect will be beneficial as long as weed growth is prevented.
- The visual impact of the remediated area will be enhanced as other parts of the Site are also remediated.

8.0 LONG TERM STEWARDSHIP

During the RFETS period of active remedation, institutional controls will be maintained throughout the SEPs area in a manner consistent with RFCA and the ALF. These documents recognize the reasonably foreseeable future land use for the SEP area is restricted open space. (Note: The RFCA Parties recognize the designation of RFETS as a National Wildlife Refuge as a conceptual land use consistent with that of restricted open space.) The institutional controls will ensure that the restricted open space land use is maintained for the SEPs area and that domestic use of groundwater is prevented. The specific mechanisms to ensure the implementation and continuity of the necessary controls have not been included in this PAM. These mechanisms will be identified and implemented through the Final Site CAD/ROD.

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9.0 BEST MANAGEMENT PRACTICE ACTIONS

Since no additional actions are needed for purposes of demonstrating closure under RCRA, the berms will be pushed into the ponds, and the area will be graded and vegetated as a best management practice (BMP).

The best management practices will involve removing any standing water within the ponds, pushing in the berms, adding clean fill to create a level area, and grading and vegetating the area. These actions will commence after the approval of this PAM, and after the completion of activities described under the ER RSOP notification. This included the removal of SEP components (e.g., facility slabs, above-grade waste lines, valve vaults, collection sumps, manholes, and other utilities), contaminated soil, lysimeters and unneeded groundwater monitoring wells, which were abandoned. Contaminated soil associated with PAC 900-1310 has also been removed. Pond liners, the OPWL, drainage tiles and leak detection lines will remain, as well as some groundwater monitoring wells. Water within the ponds will be sampled and managed based on analytical results (e.g., SPP treatment system, or transported off-site for treatment). Clean fill dirt (approximately 35,000 cubic yards) and top soil will be brought in to supplement the berms. The source of the fill may be an area between IHSS 165 and the North Perimeter Road. Grading will be performed to conform to the topography of the surrounding area (i.e., tied in uniformly with existing contours) and to provide adequate site drainage. Slopes will be kept to a minimum to reduce erosion. The area will be vegetated with native grass species. All work will be performed to comply with Site Environment, Safety and Health requirements, including ALARA and Stewardship requirements. Long-term adverse impacts from the activities are not expected.

Environmental monitoring, including downstream surface water and downgradient groundwater monitoring, will also be conducted as part of the Site-wide Integrated Monitoring Program to ensure that contaminant concentrations are not increasing and that water quality standards are being met (refer to Integrated Monitoring Plan and *Final Solar Ponds Plume Decision Document*, DOE 1999). Monitoring results will be used to determine if additional remediation is warranted.

Worker Health and Safety

All work under this proposed action will be controlled using the Site Integrated Safety Management System (ISMS) and the Integrated Work Control Program (IWCP). A project-specific Health and Safety Plan (HASP) will be developed to address the safety and health hazards of project execution and to specify the requirements and procedures for employee protection. The Occupational Safety and Health Administration construction standard for Hazardous Waste Operations and Emergency Response, 29 Code of Federal Regulations (CFR) 1926.65 will be used as the basis for the HASP. In addition, DOE Order 5480.9A, Construction Project Safety and Health Management, applies to this project. This order requires preparation of Job Hazard Analyses (JHAs) for each task, which includes identifying each task, the hazards associated with each task, and the controls necessary to eliminate or mitigate the hazards. The JHAs will be included in the HASP.

Data and controls will be continually evaluated. If field conditions were to vary from the planned approach (e.g., when unanticipated hazards are encountered, such as contaminated debris and airborne contamination), the JHA would be modified for the new conditions, and work would proceed according to the appropriate control measures.

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Water Management

If below-grade lines are encountered when pushing in the berms, special care will be taken to ensure that no liquids remaining in waste lines are released to the environment. Lines will be tapped and drained into drums and then plugged.

During construction activities, silt fences will be used to minimize soil transport. Temporary berms also could be used to control stormwater run-on and run-off, and related erosion. If water were to accumulate in the ponds during backfilling operations, the water will be transferred to the SPP treatment system as appropriate. However, the work will be conducted during the dry season, and storm events are not expected to generate significant runoff and water accumulation problems.

Air Quality Management and Monitoring

Routine, site-wide monitoring will be conducted during project execution. The K-H Air Quality Management group maintains the RFETS Radioactive Ambient Air Monitoring Program (RAAMP), which monitors the perimeter of RFETS continuously with samples collected and analyzed on a monthly basis. The RAAMP sampling network also includes monitoring stations inside the perimeter of RFETS, which are collected but not analyzed unless conditions warrant additional analysis.

Dust suppression will be performed to minimize the potential for particulate dispersion. Wind speed and direction are monitored continuously at RFETS, and these data are available through the shift superintendent.

Waste Management

Very little waste will be generated during the backfilling and seeding operations (e.g., PPE). The existing berms and liners will not be removed, but instead will be pushed into the ponds. Almost all of the waste will be generated under other actions (refer to Section 3.0). All waste generated will be managed according to Site procedures and regulations.

10.0 ADMINISTRATIVE RECORD

This section identifies the documents that constitute the administrative record file for this decision. After completion of the public comment period, all comments received from the public, the responsiveness summary, and the approval letter will be incorporated into the administrative record file. Approval of this decision document is approval by the regulators of the projects's administrative record file. The following documents constitute the administrative record file:

- Rocky Flats Cleanup Agreement, July 19, 1996 (As Updated).
- Background Geochemical Characterization Report, EG&G 1993.
- Final ER RSOP for Routine Soil Remediation, RFETS January 2002.
- Cumulative Impacts Document.
- Historical Release Reports and Annual Updates.
- Industrial Area Sampling and Analysis Plan.
- Human Health Risk Assessment, IHSS 101, Solar Ponds, August 2002.
- Solar Evaporation Ponds Closure Plan, July 1988.
- Final Proposed IM/IRA Decision Document for the SEPs, OU 4, DOE, February 1992.

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- Final Phase I RFI/RI Work Plan, OPWL, February 1992.
- Final Phase I RFI/RI Work Plan, SEPs, January 1992, as revised May 1992.
- Final TM 1, Vadose Zone Investigation, SEPs, OU 4, December 1992.
- Final TM 2 to Final Phase I RFI/RI Workplan, Modifications to Field Activities, SEPs, OU4, June 1993.
- Final TM 3 to Final Phase I RFI/RI Workplan, Modifications to Field Activities, SEPs, OU4, June 1993.
- Final TM 4 to Final Phase I RFI/RI Workplan, Modifications to Field Activities, SEPs, OU4, June 2, 1993.
- Final Phase II RFI/RI Work Plan, SEPs, September 1994.
- OU4 SEPs IM/IRA Environmental Assessment Decision Document, DOE February 1995.
- Final Solar Ponds Plume Decision Document, June 1999.
- ER RSOP for Routine Soil Remediation Notification # 02-08, DOE July 2002.
- ER IA SAP Addendum # 02-07, DOE July 2002.
- Minor Modification for the Final Solar Ponds Plume Decision Document, DOE June 2002.
- External Letter from DOW to RFAO regarding Disposition of Water from Sanitary Landfill, DOW March 1974.
- Geologic Characterization Report for RFETS, Volume I, EG&G 1995.
- Groundwater Monitoring Program for 2001 Quarterly Updates 2002.
- Solar Evaporation Pond 207C Characterization Report for RFETS, RMRS 1995.
- Final Closeout Report, Building 788 and Clarifier Tank, RMRS 1999.
- Final Closeout Report for SEPs Area, 2002.
- Final Solar Ponds Plume Decision Document, RMRS 1999.
- Management Plan for ITS Water, RMRS 1996.
- WARP Work Plan Addendum for SEPs, July 2002.

11.0 RESPONSIVENESS SUMMARY

12.0 REFERENCES

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APPENDIX A

HUMAN HEALTH RISK ASSESSMENT

SOLAR PONDS